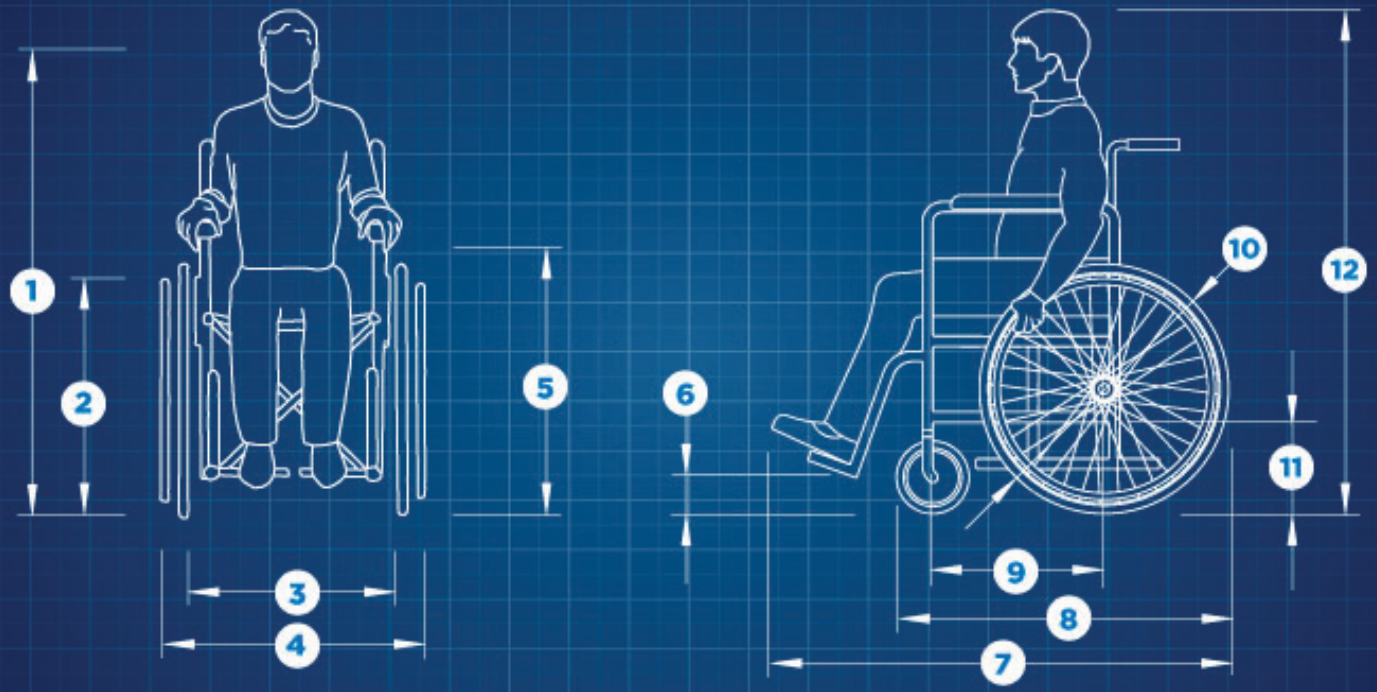


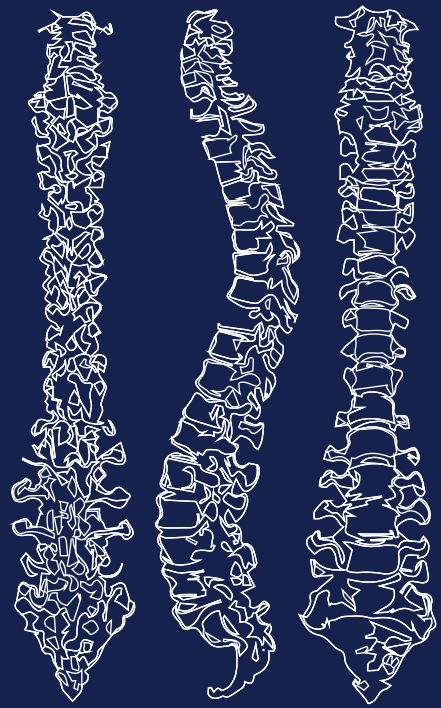
ARCHITECTURE THAT EMPOWERS

Melissa Tharp

Undergraduate Architecture Thesis
College of Architecture and Planning

Ball State University
Professor Michel Mounayar
Architectural Thesis Studio Instructor

Professor Karen Keddy
Architectural Thesis Advisor



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01 abstract

The focus of this thesis is to understand how architecture can address the physical and psychological needs of spinal cord injury patients through design. Healing environments is a popular topic in other areas of healthcare architecture but among spinal cord injury centers it is not being discussed. The unique needs of these patients make it critical that architects contribute to these discussions. We as designers need to consider how to improve healing spaces. Architecture should be responsive; striving to adapt to the needs of patients who have spinal cord injuries (SCI) by empowering, protecting, and healing both psychologically and physically.

The mental health of spinal cord injury patients is a prominent discussion in the medical realm, but from what I can see, no one is talking about the psychological impacts that these spaces are having on people. "Suicide was the leading cause of death for persons with complete paraplegia and the second leading cause of death for persons with incomplete paraplegia"[1]. This suggests that spaces need to be designed in a way that helps these people feel connected to society and understand that they belong.

Research shows that 50% of all spinal cord injuries are caused by car accidents and every 60 seconds there is a car accident in the US.[2] Somewhere between 240,000 and 337,000 people in the US have a spinal cord injury and there are only 14 "model centers" in the US according to the National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR)[3]. International Building Code (IBC) and Facility Guidelines Institute (FGI) have little to nothing to say about spinal cord injury centers, which means that facilities are being built that do not address the specific needs of these individuals and their unique circumstances.

1 DeVivo, M J, K J Black, J Scott Richards, and S L Stover. "Suicide Following Spinal Cord Injury." Nature News. Nature Publishing Group, n.d. https://www.nature.com/articles/sc199191.
2 "Spinal Cord Injury (SCI) Model System." SCI Model System | Model Systems Knowledge Translation Center (MSKTC), May 1, 1970. https://msktc.org/about-model-systems/sci.
3 - NSCISC Application, n.d. https://www.nscisc.uab.edu/Public_Pages/FAQ.

02 thesis proposal

Figure 2.1 Man in Exoskeleton

Figure 2.4 Model Center Map

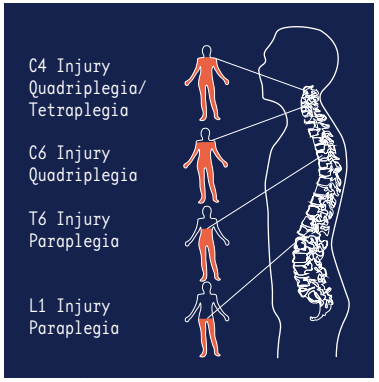


Figure 2.5 Levels of Injury

Figure 2.2 Man with Paraplegia in Wheelchair

Figure 2.3 Woman with Quadriplegia in Wheelchair

Suicide is the leading cause of death for people with complete paraplegia[1]. It is the second leading cause of death in people with incomplete paraplegia. 50% of all spinal cord injuries are caused by car accidents and every 60 seconds there is a car accident in the US[2]. The majority of suicides occurred between 1-5 years after the injury which is why this project is a long term care facility. By designing a long term care center, I can create spaces specifically for people battling with depression. With advances in medicine, people are surviving traumatic events that result in spinal cord injuries. Therefore, the number of spinal cord injuries is expected to increase. There are no standards for spinal cord injury rehabilitation centers except for the model center guidelines which do not speak to anything architectural. "A Model System must be able to meet the needs of a person with SCI by competently treating the direct injury as well as all organ systems affected (of which there are many); the functional deficits that result, by providing training and equipment; the psychological adjustments that must be made; the vocational/avocational pursuits that must be changed; and the providing of long-term specialized care.[3]" In addition, there are only 12 model centers in the nation. This gap in care is a significant one that I believe has the ability to impact people in a powerful way. There are three different levels of injury that this project is specifically working with; quadriplegia, paraplegia, and walking with the assistance of an exoskeleton. Quadriplegia is the most severe of the injury levels; it means that the individual has little to no mobility from the neck down. They often have custom motorized wheelchairs. The next level of injury is paraplegia in which individuals are paralyzed from the waist down. The last injury level this project works with is people who were paralyzed but are re-gaining function of their legs and can walk using an exoskeleton.

1 "Spinal Cord Injury (SCI) Model System." SCI Model System | Model Systems Knowledge Translation Center (MSKTC), May 1, 1970. https://msktc.org/about-model-systems/sci.
2 "Spinal Cord Injury (SCI) Model System." SCI Model System | Model Systems Knowledge Translation Center (MSKTC), May 1, 1970. https://msktc.org/about-model-systems/sci.
3 "Spinal Cord Injury (SCI) Model System." SCI Model System | Model Systems Knowledge Translation Center (MSKTC), May 1, 1970. https://msktc.org/about-model-systems/sci.

This research is the foundation of my thesis because it paints a picture of where we have been so that we do not repeat mistakes or lessons learned of the past; specifically, research about the history of patient socialization, daylighting/views, and colors/textures.

Healthcare architecture has experienced several revolutions over the years involving daylighting, sustainability, accessibility, integrated technology, healing gardens, and meditation spaces. Mental health has been a rapidly growing discussion in healthcare architecture as well. These two areas of architecture speak to my specific place-type of spinal cord injury centers.

For many years Spinal Cord Injury was believed to require calm, quiet, almost isolated spaces for rehabilitation. The thinking was that people would prefer to rehabilitate in private without seeing the hustle and bustle of the life they had before their injury. It also pressed into these ideas of healing through quiet, reflective spaces. Although these ideas are good individually, research about patient socialization has proven them to be ineffective.

"The current study clearly emphasizes the importance of patients being able to escape the clinical environment and to socialize with other patients and family visitors to prevent loneliness and boredom when formal therapy sessions are not occurring. Patients in another study agreed with these findings and commented on boredom and lack of stimulation which impacted their morale and their progress in rehabilitation. In addition, as in our current study, other research has indicated that providing areas where patients can meet together and discuss their various rehabilitation journeys allows a culture of motivational peer support and helps maintain their energy and interest in the rehabilitation process. Other research has shown the many physical and psychological benefits of allowing patients access to their pets while they are in the hospital. This current research also indicates that patients require somewhere suitable to meet with their visiting pets to reduce their anxiety and lift their mood.[1]"

This research would suggest programmatical changes that need to occur in the design of spinal cord injury rehabilitation centers to include more spaces for meeting and social engagement.

Daylighting and views has not always been a concern in healthcare architecture. In the past it was not something that was considered in the design of hospitals and rehabilitation spaces. Today, it is a topic that has been discussed very thoroughly and few facilities would say that they do not want to maximize daylighting and views for patients. This shift in design happened in the mid to late 19th century, but spinal cord injury has not seen the effects of this shift in the design of facilities. "Light is a phenomenon which we usually take for granted: we are usually unaware of the nature of light in a space until we are forced to attend to it.[2]" Many spinal cord injury facilities still do not have access to these qualities that hospitals, cancer centers, doctor's offices, and more have so actively sought to obtain.

In the past the stereotype of hospitals was muted colors or textures which were viewed as more appropriate in calming patients mentally. These dull colors were thought to normalize the experience of the patient and subdue them[3]. This has since been proven to be completely inaccurate thinking. Research has shown that vibrant colored rooms promote healing more so than dull colors.

Current discussions in Spinal Cord Injury rehabilitation centers

1 Killington, Maggie, Dean Fyfe, Allan Patching, Paul Habib, Annabel McNamara, Rachael Kay, Venugopal Kochiyil, and Maria Crotty. 2019. " Health Expectations 22 (3): 396-404.
2 Lang, Jon T. Designing for Human Behavior: Architecture and the Behavioral Sciences. Stroudsburg, Pa: Dowden, Hutchinson & Ross, 1974.
2 Kalantari, Saleh and Robin Snell. 2017. "Post-Occupancy Evaluation of a Mental Healthcare Facility Based on Staff Perceptions of Design Innovations." HERD : Health Environments Research & Design Journal 10 (4) (07): 121-135.

are that patients need all these qualities that have been discussed for years now; daylighting, views, quiet, peaceful spaces, etc. In addition, there are growing needs for architecture to adapt to the larger role that technology plays in the rehabilitation process. Exoskeleton, AI, and robotics have become a common practice in spinal cord injury rehabilitation. To the right are examples of what many SCI centers look like in the United States. They do not have windows or natural lighting, they are unorganized, cold, clinical, have low ceilings, and poor material choices.

Exam Room

- No windows or natural lighting
- Unorganized equipment
- Cold, clinical environment

Figure 2.6 Exam Room

Physical Therapy Room

- No windows or natural lighting
- Low ceilings
- Clinical environment

Figure 2.7 Physical Therapy Room

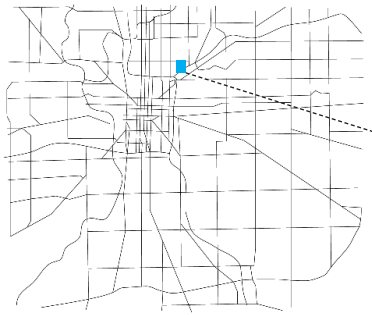
Multipurpose Room

- Low quality daylighting
- Poor material choices that do not promote a healthy environment.
- Low ceilings
- Clinical environment

Figure 2.8 Multipurpose Room

Site Context: Physical and Cultural

Figure 2.9 Site from West-South



Indianapolis, IN

Figure 2.10 Site from West

Figure 2.11 Abandoned apartment building

Site Selection Criteria

- Close proximity to downtown Indianapolis
- Connected to city through public transportation, sidewalks, and bike paths.
- Cloe proximity to restaurants and entertainment.
- Accessible site.

Sixteenth street and College Avenue is currently a very run-down city block. It does not feel safe or inviting, but in the near future it is going to be a very thriving community. Everyday new apartment buildings and restaurants are going up. It is an up and coming neighborhood which holds a great deal of promise for a Long Term Care Spinal Cord Injury Center. The site is close in proximity to downtown Indianapolis. It offers a variety or entertainment and dining options if residents desire to connect with the city. Although the site holds a lot of potential in the future, my analysis is a reflection of the site today.

Traffic was very heavy when I was walking around the site because it

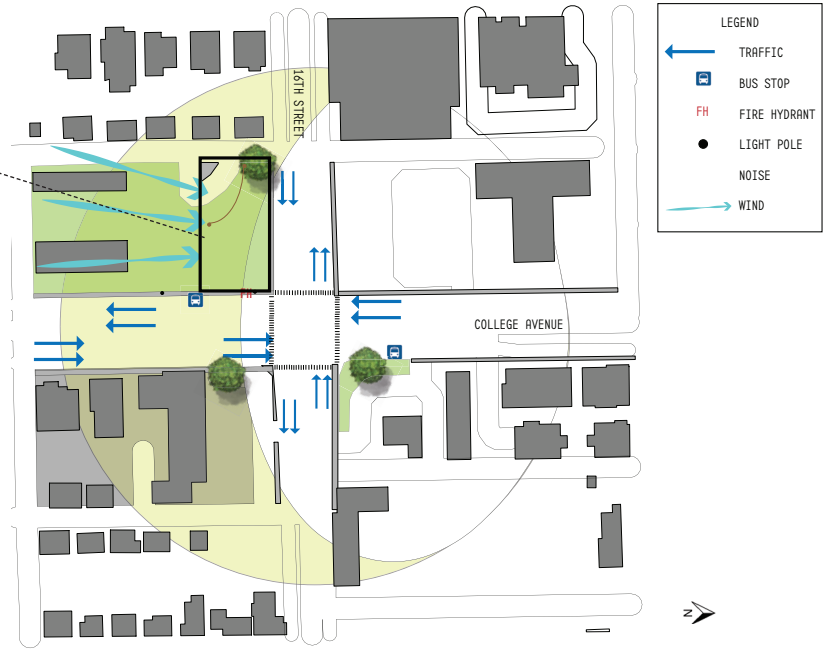
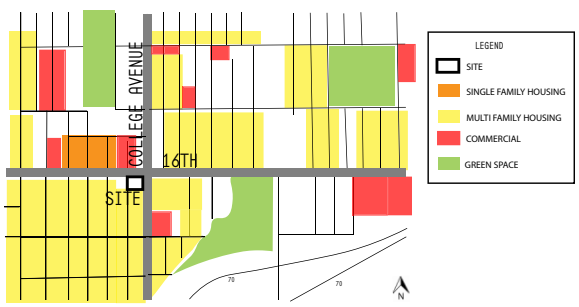


Figure 2.12 Site Analysis

Figure 2.13 North of site across 16th Street

Figure 2.14 Sidewalk on East side of site.



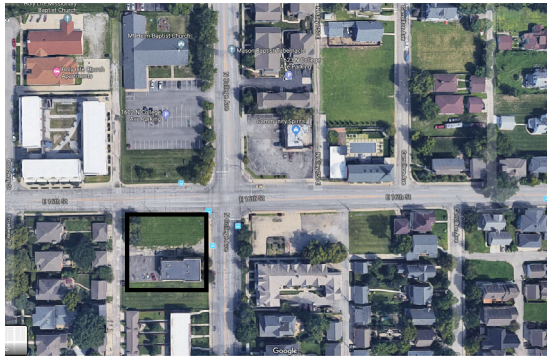
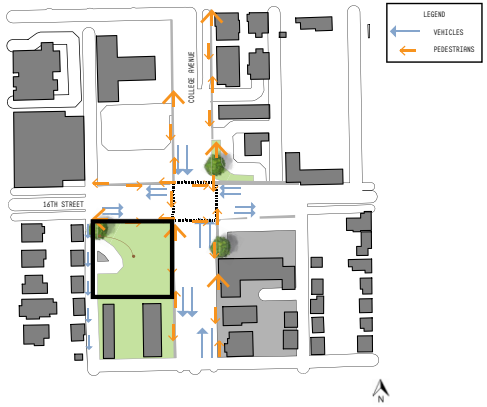


Figure 2.15
Site: 16th & College Avenue, Old Northside Indianapolis IN



Site Analysis Diagram

was almost rush hour in Indianapolis. There was significant honking and screeching of tires. The trees were rustling because of the strong winds. Debris and discarded items were blowing across the site and road. People were walking on the sidewalks and talking to one another. A few people who live in the surrounding apartments were walking their dogs. As time went by, more and more people could be seen walking down College Avenue.

The site is an empty lot at the corner of 16th and College Avenue. The site also includes a brick two-story apartment building. The building is abandoned currently and boarded up. Historically there was a house on the site, but it has since been torn down, leaving the site vacant. The site is lined with sidewalks that are cracked and uneven. Weeds are growing in the cracks of the sidewalk, causing the bock to feel completely abandoned. There are black street lights lining College Avenue, but the one in front of my site is broken. A fire hydrant is also located on the sidewalk on the east side of the site adjacent to the street light.

The site is covered in a grassy plane that is not maintained well. Trash, weeds, and gravel are littered all over the site. There is a tree on the north-west side of the site that is roughly 35ft tall. The tree limbs hang low due to lack of maintenance. There is also a power line running from the building adjacent to the site to a pole located by the tree on the north-west side of the site. There are no benches or seating areas around the site. Even at the bus stops, there are no benches or structures to protect

people from the weather. The soil has a lot of gravel and crumbled concrete in it which points to the remains of the building that once stood on the site. The ground plane is uneven and irregular.

College and 16th street are both four lane roads with traffic going in both directions. The traffic is very noisy and busy. People are speeding around, constantly in a hurry to get where they are going. The area does not feel safe, but the surrounding area is an up and coming neighborhood. There is evidence that people walk the sidewalks, but a bike path has not been established in this area yet. The north and east sides of the site are defined by the sidewalk and street edge. The south side of the site is defined by the abandoned apartment building. Lastly, the west side of the site is defined by a driveway that leads to the abandoned apartment building. The site is almost taking over the side walk on the north side of the site which only adds to the unsafe and abandoned feelings around this intersection. At 4:30pm the site is predominately in shade due to the abandoned apartment and the tree located on the north-east side of the site. The smell of vehicle exhaust is prominent around the site as well as the smell of grass blowing through the site from the strong winds.

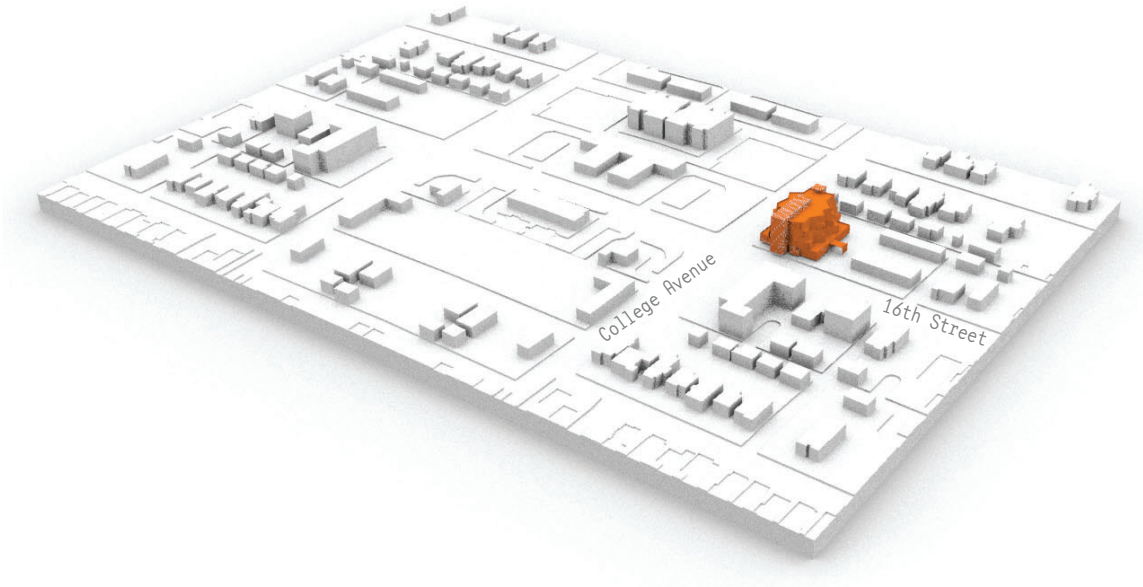


Figure 2.16 Monumental Scale Model

precedents

SHIRLEY RYAN ABILITY LAB
GENSLER
2016

Chicago, Illinois

Figure 2.17 Exterior of Shirley Ryan

The Shirley Ryan Ability Lab is a 27 story "rehabilitation destination for adults and children with the most severe, complex conditions – from traumatic brain and spinal cord injury to stroke, amputation and cancer.[1]" The facility uses bright colors and curvilinear forms to create a vibrant rehabilitation space. Spectacular views in all the rehabilitation spaces and patient rooms overlooking Chicago enhance the quality of the patients' stay. In this Lab, patients, doctors, and researchers focus on body-weight support and large motor and rhythmic limb functions influenced by spinal cord and brain circuits. Therapeutic intervention makes use of anti-gravity support and weight-bearing assistive devices, which are used to support patients as they work on climbing and descending the Lab's staircase. Treatments focus on trunk and pelvis stability, positioning and control of the hips, knees and ankles, as well as stepping and propulsion.[2]"

1 "Shirley Ryan Ability Lab: Projects." Gensler. Accessed November 7, 2019. https://www.gensler.com/projects/shirley-ryan-abilitylab.
2 "Legs Walking Lab." Shirley Ryan AbilityLab - Formerly RIC. Accessed November 7, 2019. https://www.sralab.org/research/abilitylabs/legs-walking-lab.

Figure 2.18 Ability Lab

Figure 2.19 Patient Room

Figure 2.20 Ability Lab Stairs

Figure 2.21 Ability Lab

"The 27-story, 1.2-million-square-foot facility is the first-ever "translational" research hospital in which clinicians, scientists, innovators, and technologists work together in the same space – surrounding patients, discovering new approaches and applying (or "translating") research real time. This translational approach means patients have 24/7 access to the brightest minds, the latest research, and the best opportunity for recovery.[1]" This approach to research is very integrated. While patients are in rehab, researchers and doctors are observing their progress. In doing so they are constantly learning, exploring, and testing new forms of treatment for each individual patient. The visual connection that doctors, therapists, and researchers have to patients is what makes this center so successful.

1 "Shirley Ryan AbilityLab: Projects." Gensler. Accessed November 7, 2019. https://www.gensler.com/projects/shirley-ryan-abilitylab.

SPAULDING HOSPITAL

PERKINS + WILL

2013

300 1ST AVE, BOSTON, MA 02129

"Located on a remediated brownfield parcel in the Charlestown Navy Yard, the building is a newgathering place for the community – dedicating 75 percent of the first floor to public use and integrating with the Boston HarborWalk.[1]"

1 Alarcón, Jonathan. "Spaulding Hospital / Perkins Will." ArchDaily. ArchDaily, November 1, 2013. https://www.archdaily.com/443408/spaulding-hospita-perkins-will?ad_source=search&ad_medium=search_result_all.

Figure 2.22 Meeting Room

Figure 2.23 Aquatic Therapy Gym

Figure 2.24 Physical Therapy Gym

"Tied to the site's naval yard history, the gray materials of the facade are reminiscent of the military battleships and aircraft carriers berthed at the Yard for much of the 20th century. The scale of the building is visually reduced by dividing the structure into two connected sections – an eight-story patient tower and a three-story therapeutic gymnasium and pool.[1]" The hospital also has generous amounts of glazing with views out onto the water. The respect for the history of the site that was implemented in the design while still creating a modern facility created a beautiful result. The site has shadows of the past sprinkled throughout it with reclaimed timber. The site is composed of several different materials that are used for patients to practice walking and using their wheelchairs, which creates an active and dynamic site that patients can rehabilitate in.

1 Alarcón, Jonathan. "Spaulding Hospital / Perkins Will." ArchDaily. ArchDaily, November 1, 2013. https://www.archdaily.com/443408/spaulding-hospita-perkins-will?ad_source=search&ad_medium=search_result_all.

ST. JOHN'S REHAB

MONTGOMERY SISAM ARCHITECTS + FARROW PARTNERSHIP ARCHITECTS
2011

300 1ST AVE, BOSTON, MA 02129

St. John's Rehab is a rehabilitation project that also had an addition added to it. During the renovation, they opened up the clinical spaces to create a more fresh, inviting space. "The addition consists of two large rehabilitation gyms, associated clinical offices, a new therapy pool and a relocated, grade level central drop off and entry. A generous, single-loaded corridor provides the primary circulation for the addition at both levels. Not only does it provide access to a wide range of multi-disciplinary treatment spaces, it offers views into a new therapy garden and the ever-changing landscape. At the same time, it is an ideal setting for patients to work independently on their rehabilitation treatment and gradually regain mobility and confidence.[1]"

Figure 2.25 Aquatic Therapy Gym

Figure 2.26 Physical Therapy Gym

1 Ross, Kritiana. "St. Johns Rehab / Montgomery Sisam Architects Farro w Partnership Architects." ArchDaily. ArchDaily, February 24, 2012. https://www.archdaily.com/211220/st-johns-rehab-montgomery-sisam-architects-farro%e2%80%8bw-partnership-architects?ad_source=search&ad_medium=search_result_all.

03 thesis project

Design Objectives

The design objectives for this project were to develop a long term care spinal cord injury center that promotes healing both physically and psychologically. By creating opportunities for community, I believe Architecture can improve the outcomes for people with spinal cord injuries. Community takes place on three different scales throughout the building; the city level, the neighborhood level, and the family level. This analogy directly applies to each floor of the building. Another design objective for this project was that residents be able to move between floors without the hindrance of an elevator or other obstructions. Additionally, I wanted to include personal gardens and full area lifts in every resident room with maximized clearances around the bed in order to encourage independence among the residents.

Evaluation Criteria

The evaluation criteria for this project can be broken down into four categories: community, high quality design, daylighting, and circulation. The evaluation criteria for community is that there are opportunities for social interaction on every floor and have spaces for public events. The criteria for evaluating high quality design is that there be generosity of space for accessibility, views and access to nature, high ceilings, colorful spaces, and natural materials. The evaluation criteria for daylighting is that there be daylighting in every space for residents. The evaluation criteria for circulation is that vertical circulation be accessible without the use of elevators and that circulation spaces be generous in order to allow for accessibility.

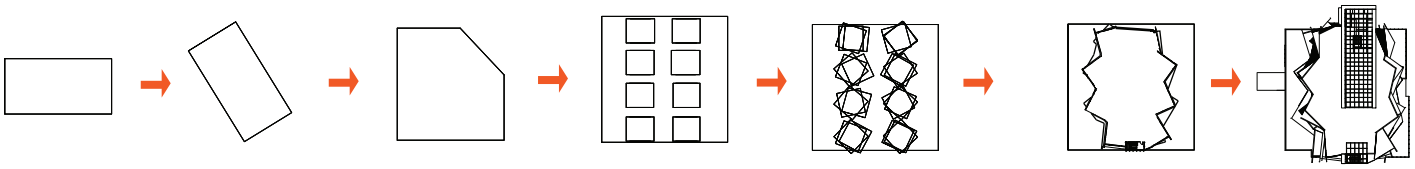


Figure 3.1 Form Process

The form came out of a series of iterations shown above. The evaluation criteria is how I got to the end design. The first step in the process was a simple rectangle that would meet the street and maximize the use of the site. Then I evaluated the criteria and realized the form did not meet my daylighting requirements since the elongated sides of the building were north-south facing. I wanted the resident rooms which would span the exterior of the building on the longest side of the building to be facing east-west in order to ensure each resident would have sunlight during the day. Then I expanded the building onto the adjacent site and extended the building to meet the sidewalk. The reason for meeting the sidewalk was to provide opportunity for public engagement at the street level. Then I started adding towers, which were the resident rooms on top of the main level, so that the rooms were facing east-west. I wanted every room for the residents to have access to natural lighting. Then I decided to start twisting the towers so that the rooms could have access to daylighting on two sides instead of just one. This became the language for all the floors above the first level. I then began stepping the floors back as I went up so that the floor below could be a roof-top garden. This would give each resident access to daylighting and a beautiful garden right outside their window. The last step was the addition of a ramp. I desired for the residents to be empowered through the circulation. I accomplished this by giving them the ability to move between floors without the use of an elevator.

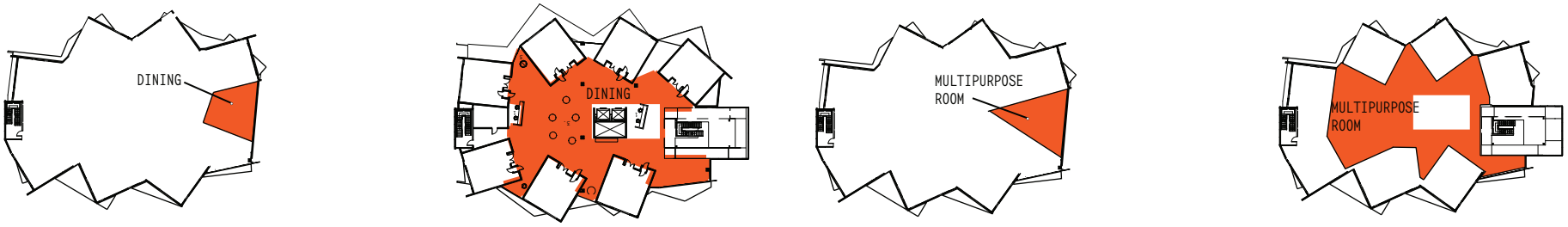


Figure 3.2 Dining and Multipurpose Room Process

The dining room is located on the third level of the building and it was designed to be a "neighborhood" social space for the residents. The dining room serves all of the residents in the facility. Originally in the process the dining room was just a room. It was located along the perimeter of the building in order to have access to daylighting. Then my thought process shifted as I started prioritizing community over daylighting in these social spaces. Making these spaces the center of the building became critical to their success. This then evolved into a dining room that felt more like an open plaza cafe. Residents can eat in the main dining area at the center of the building or they can find a table located throughout the floor. Having a variety of places to eat was desired since these people will eat all of their meals here. Residents can find a table for whatever mood they are in; a table with a view of the street, or a place to people watch, or a table at the hub of the dining area in the center of the building. These design decisions help facilitate the empowerment of people with spinal cord injury by giving them freedom and choices.

The multipurpose room is located on the fourth level of the building and was designed to be a "neighborhood" social space for the residents. It is also a shared space between all of the residents which offers activities, television, ping pong, and board games. Originally in the design process, I wanted these community social spaces to be on the perimeter of the building in order to get lots of natural lighting. Then my thought process shifted as I started to think of these spaces as not just rooms with four walls. Instead, the multipurpose "room" became something more akin to a plaza. This design shift also came about through the evolution of the idea of chance encounters with other people. By making the multipurpose room flow throughout the floor it creates more opportunities for people to see others playing games, watching a movie together, painting, or just talking which can increase their likelihood in participating. Giving people with a spinal cord injury a sense of belonging and purpose is why community is so important to this project.

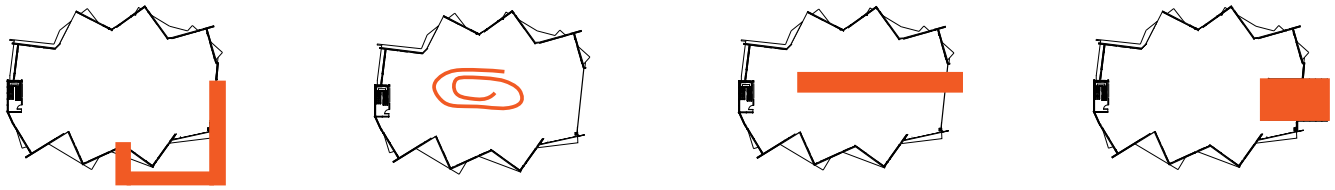


Figure 3.3 Ramp Process

The ramp began as a way for residents to get from the third level to the fourth. The ramp would allow residents to move freely between floors which contained the multipurpose room and dining room which they would be using frequently. I first explored an exterior ramp that would have great prominence on the exterior facade and wrap around the side. It was a way to celebrate the movement within the building as an architectural expression. Then I looked into an interior ramp because there were significant conflicts between the ramp on the exterior that wrapped the building and the views out of the resident rooms. I explored two interior ramp designs extensively. The first was a spiral ramp and the second was a straight ramp that would span almost the entire length of the building. After exhausting these ideas I explored one more option for the ramp. This design was a combination of all of the previous ramp designs. The final ramp design was a spiral ramp that was partially embedded into the building and half protruding from the building. This not only freed up a significant amount of the floor area but it presented itself as a prominent architectural move on the exterior. The ramp exemplifies what this building is about; empowering people.

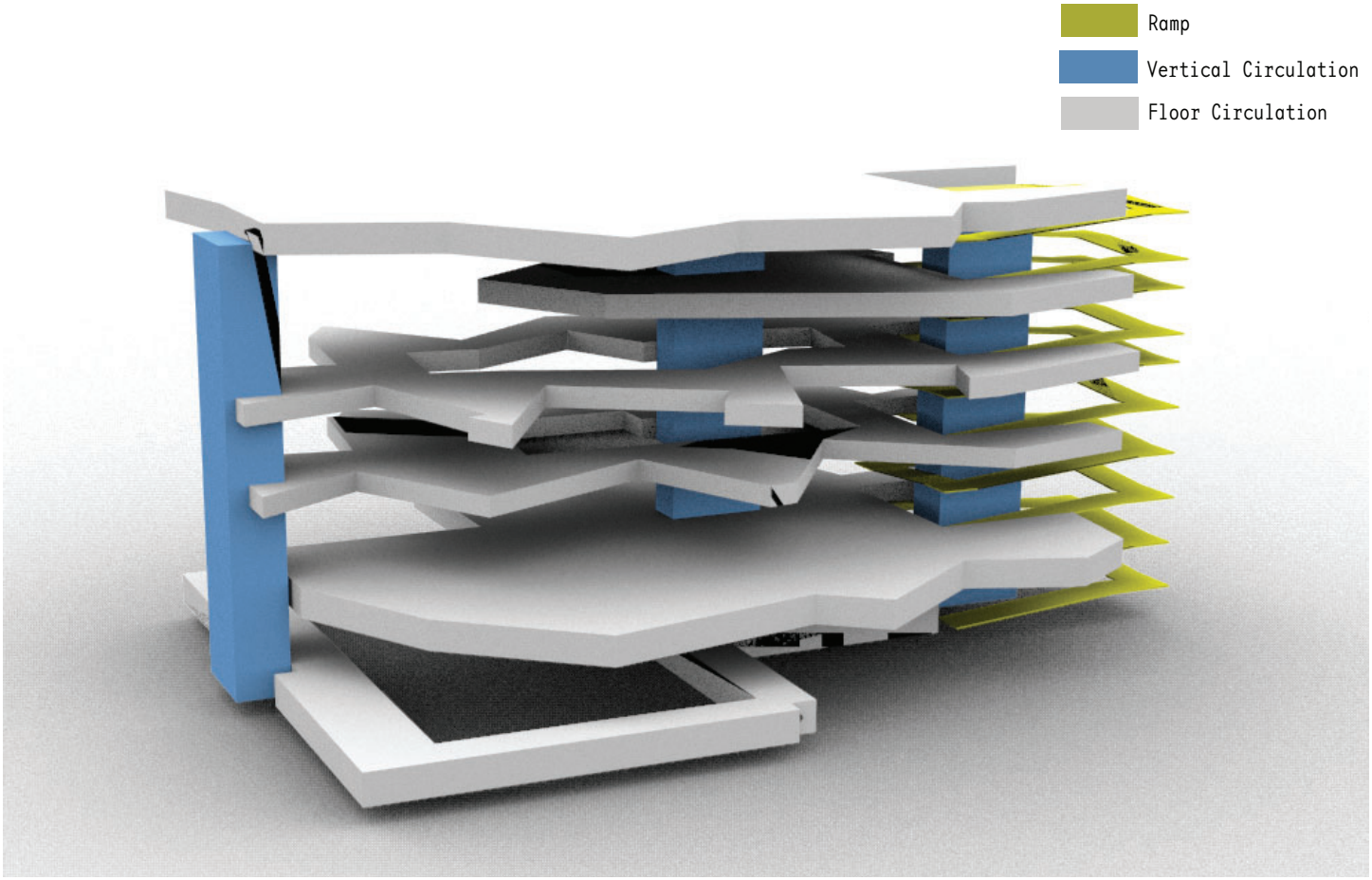


Figure 3.4 Circulation Model

This diagram shows the circulation throughout the entire building. Significant space was allocated to circulation so that residents can move freely throughout the building. The ramp takes up an incredible amount of the building which is a testament to how important accessibility is to this project. Empowerment for people with SCI happens by giving them independence in as many ways as possible.

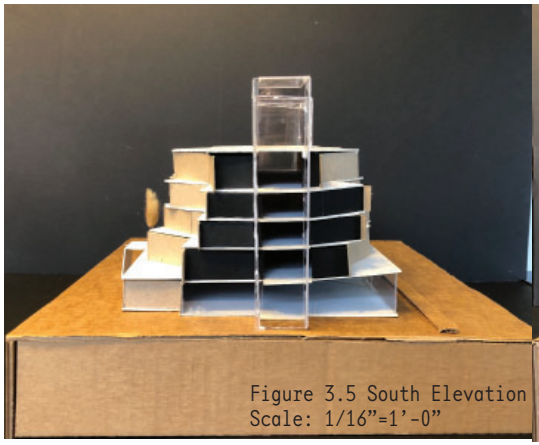


Figure 3.5 South Elevation
Scale: 1/16”=1’-0”

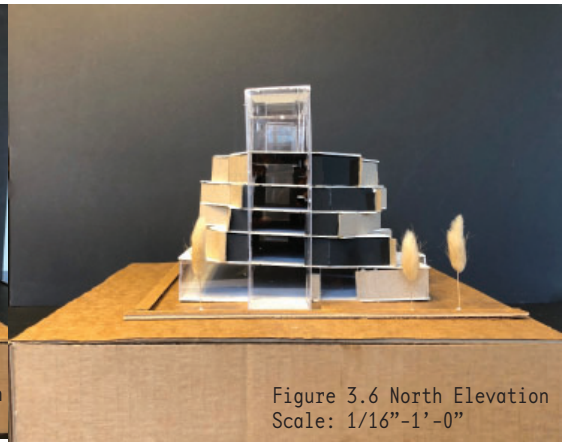


Figure 3.6 North Elevation
Scale: 1/16”-1’-0”

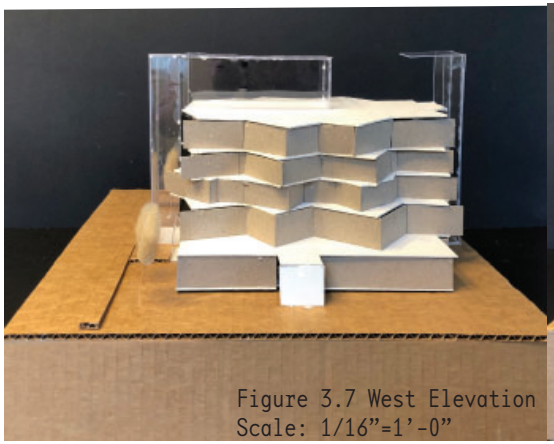


Figure 3.7 West Elevation
Scale: 1/16”=1’-0”

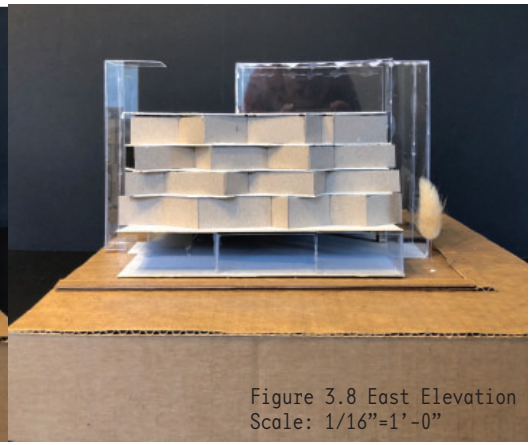


Figure 3.8 East Elevation
Scale: 1/16”=1’-0”

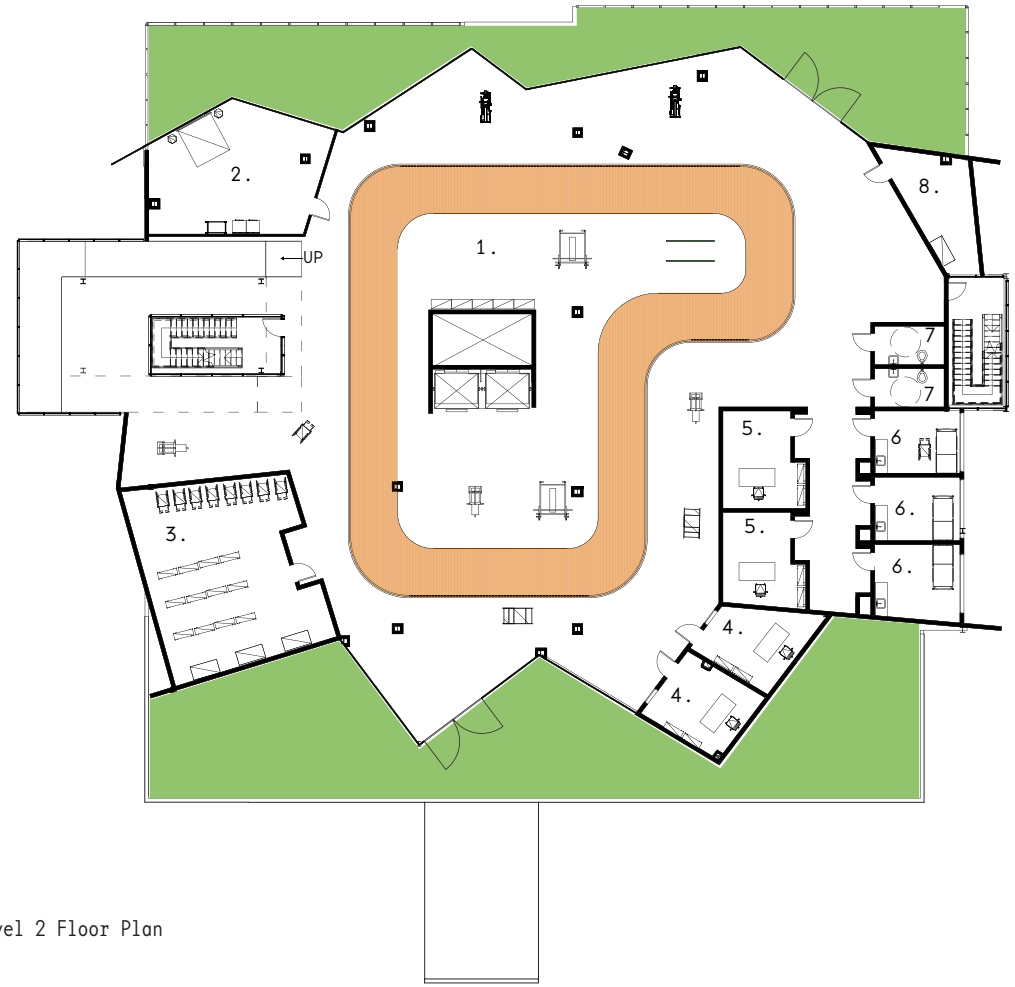
The exterior of the building was a result of designing from the inside-out. I approached this project in such a way as to give the residents a facility designed for their needs first and foremost. As the building progressed, I started to view the exterior as two pieces; the glass box and the planes. This language promoted the ramp which is what I desired.

Figure 3.9 West Exterior Perspective

The resident drop off is located on the west side of the building. The entrances to the building are highlighted by the use of living walls. The use of living walls gives it a human touch. The power of nature in the healing process is undeniable which is why it is only fitting that it is what guides residents and visitors to the entrances to the center. In addition, wood composite paneling is found on the ground level. Natural materials were implemented on the ground level to provide the human touch and scale. The top levels are a combination of aluminum paneling and partially opaque glass.

Figure 3.10 Level 1 Floor Plan

Level one is a “city” level of community with the goal of engaging with Indianapolis in a variety of ways. The gymnasium is one of the biggest ways the facility will bring the public in. Wheelchair basketball teams can use the court for practice or tournaments. Conferences, events, classes, and more can be held in the gymnasium. The gymnasium also has a stage which can be used for theatrical events and speaking engagements. Lastly, the aquatic therapy pool can be used to host swim classes.



1. Physical Therapy Gym
2. Activities of Daily Living
3. Storage
4. Physical Therapist Office
5. Doctor's Office
6. Exam Room
7. Toilet Room
8. Wheelchair Workshop

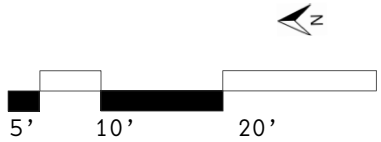
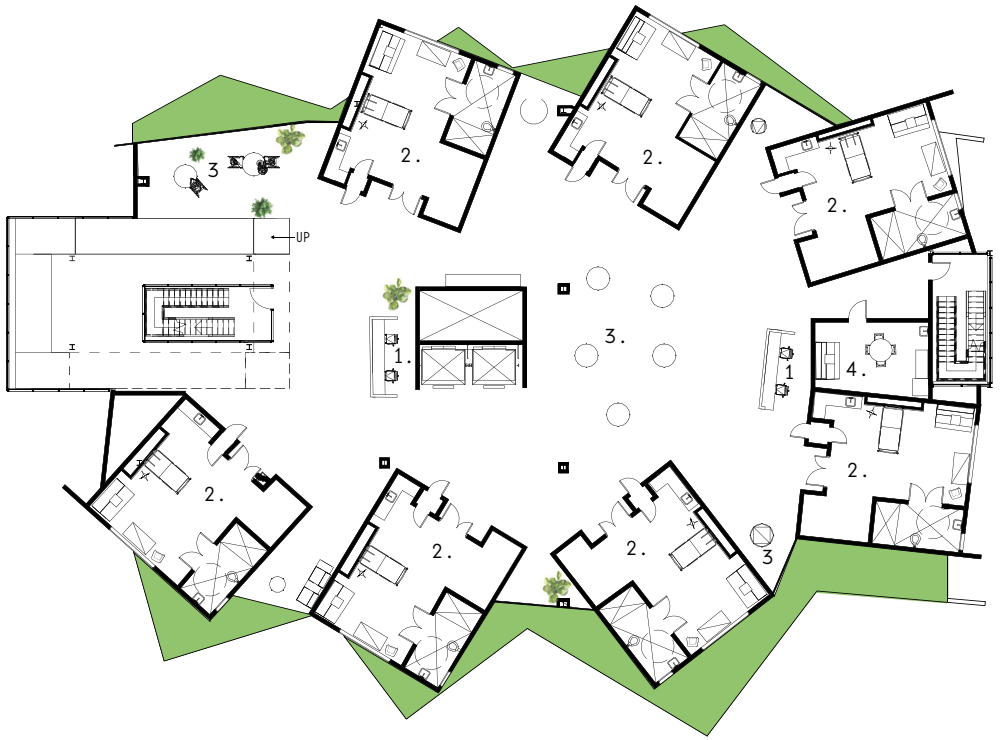


Figure 3.11 Level 2 Floor Plan

Level two is a "neighborhood" level of community with the goal of creating a more cohesive therapy environment where residents can rehab together. Physical therapists' and doctors' offices are located within the therapy gym so that they can observe their patients' therapy taking place and be more involved in their care. This level also has an activities of daily living suite where residents can work with a physical therapist on getting in and out of a standard bed, doing laundry, washing dishes, etc so that someday they can go home and be fully independent.



1. Nurse Station
2. Resident Room
3. Dining
4. Staff Break Room

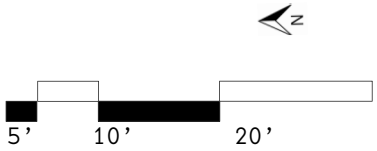


Figure 3.12 Level 3 Floor Plan

Level three is a resident floor which falls under the “family” level of community. The goal of this level is to create a family atmosphere. This idea of family is why there is only seven rooms on each floor. By keeping the number of rooms to seven it ensures that residents will know each other and easily be able to get to each other’s room and the social spaces such as the dining room. Each resident room door is recessed in order to create a front porch feeling. In addition, there is a shelf by the door for residents to place things while they open the door, or they can personalize the shelf with decorations.

1. Nurse Station
2. Resident Room
3. Multipurpose Space
4. Art Space
5. Staff Toilet Room
6. Storage

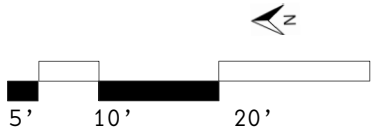
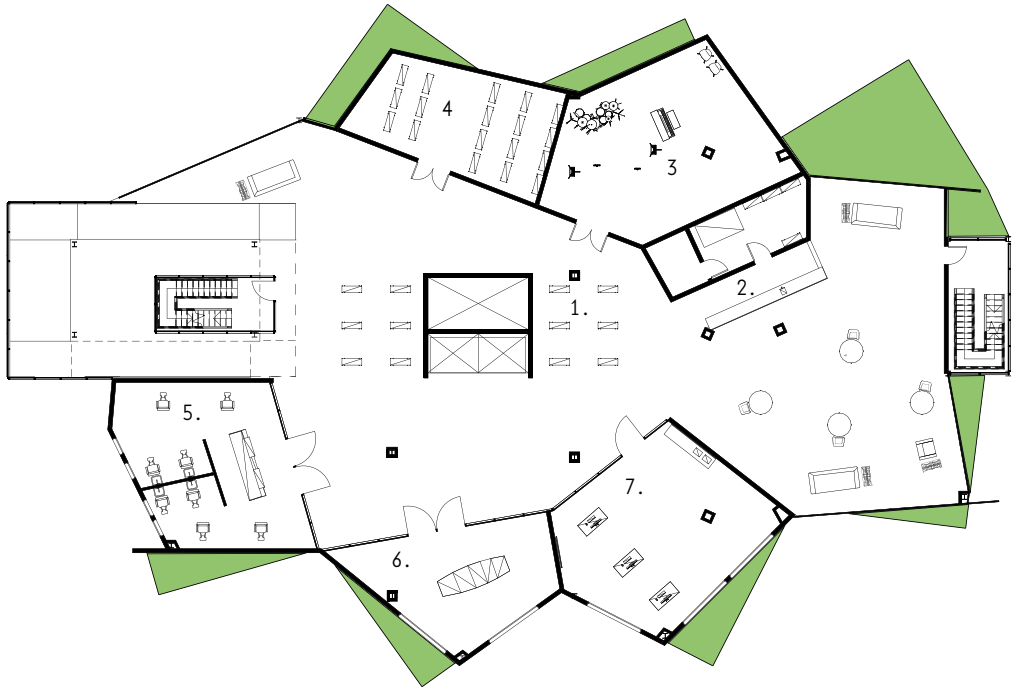


Figure 3.13 Level 4 Floor Plan

Level four is similar to level three except for variations in the angle of the rooms, and instead of dining, this level has the multipurpose space. Nurse stations are located at both ends of the floor which is true on the third level as well. This cuts down on th distance nurses have to travel to each resident room and provides greater visibility for nurses.



1. Library
2. Coffee Shop
3. Music Room
4. Storage
5. Barbour Shop/ Hair Salon
6. Conference Room
7. Business Room

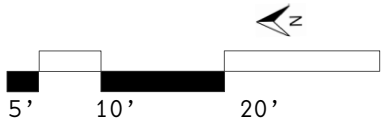


Figure 3.14 Level 5 Floor Plan

The fifth level is a “neighborhood” level of community where the goal was to encourage social gatherings but also to provide services to the residents such as a hair salon/barber shop, business center, conference room, coffee shop, library, and music room. Many individuals with spinal cord injuries are working individuals who continue in their career after their injury. This is why having spaces to work in is very beneficial to their health and future. Music has often been used as a tool for lowering depression and encouraging creativity, which is why a music room was chosen in the design of this level.

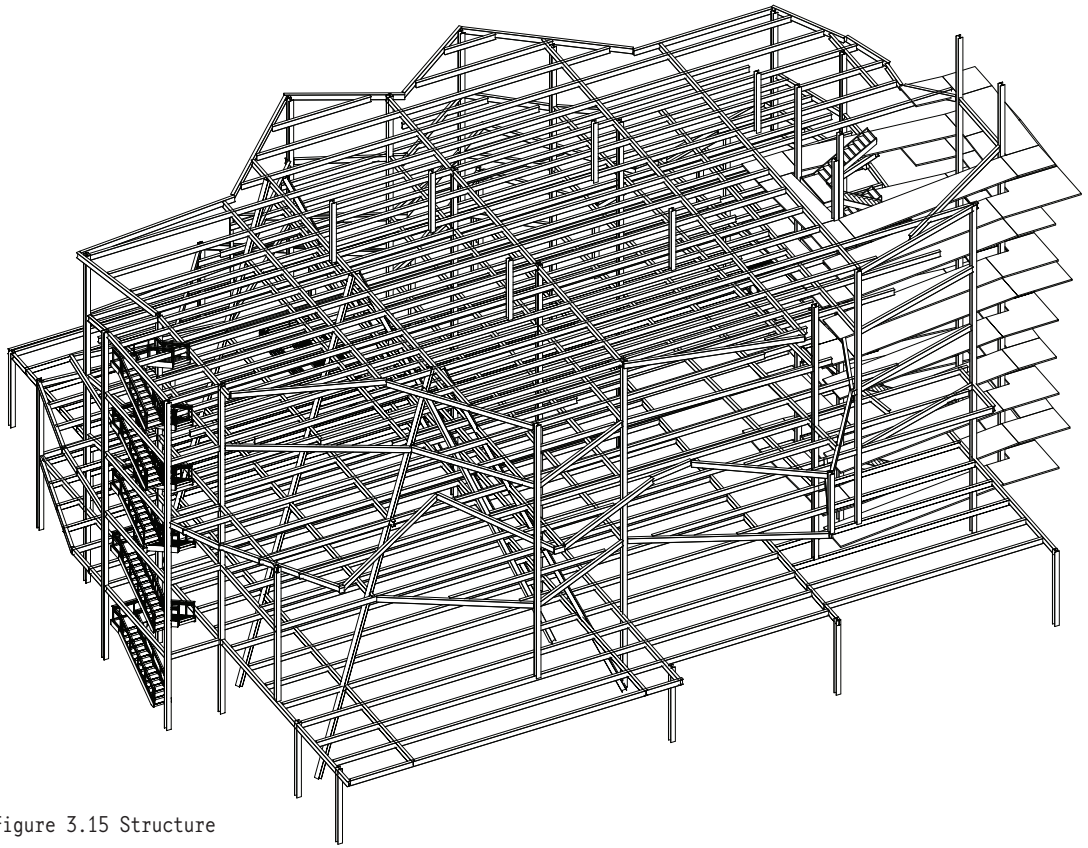


Figure 3.15 Structure

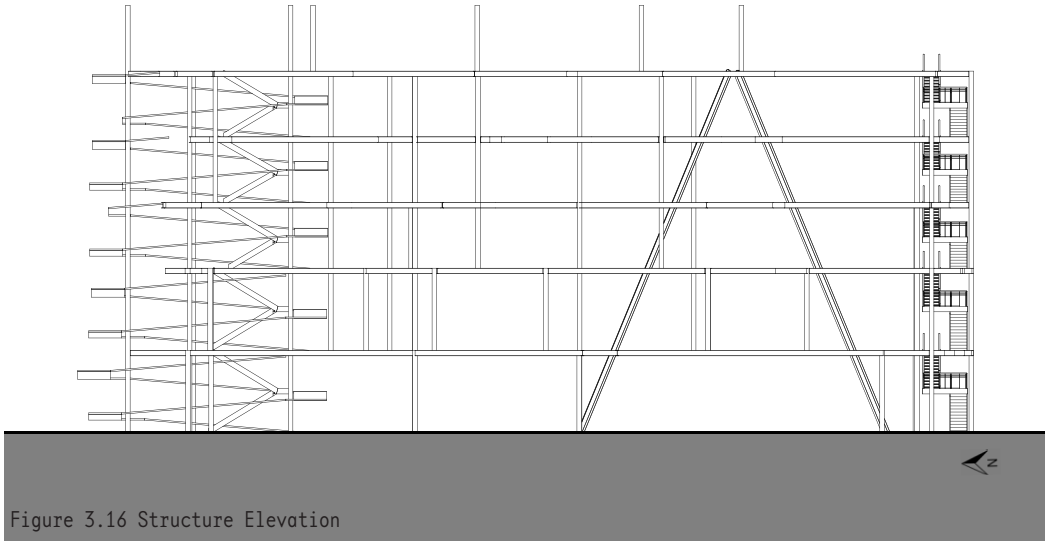


Figure 3.16 Structure Elevation

The structure of this building is a post and beam steel structural system. Steel provided the spans I desired and would meet the code requirements for this building typology. The building has a series of angled steel columns in order to accommodate the building's form which steps back as you go up. In addition, the gymnasium on the ground floor required a unique solution in order to keep it column free. Angled columns allowed me to keep the gymnasium column free and support the receding floors above.

Figure 3.17 East Exterior Perspective

As you approach the building from 16th street and College Avenue the gymnasium is visible along with the aquatic therapy. Whether it is a game of wheelchair basketball, a group of residents swimming in the pool, or residents wheeling down the ramp, the building highlights the movement and life within the building.

Environmental Response

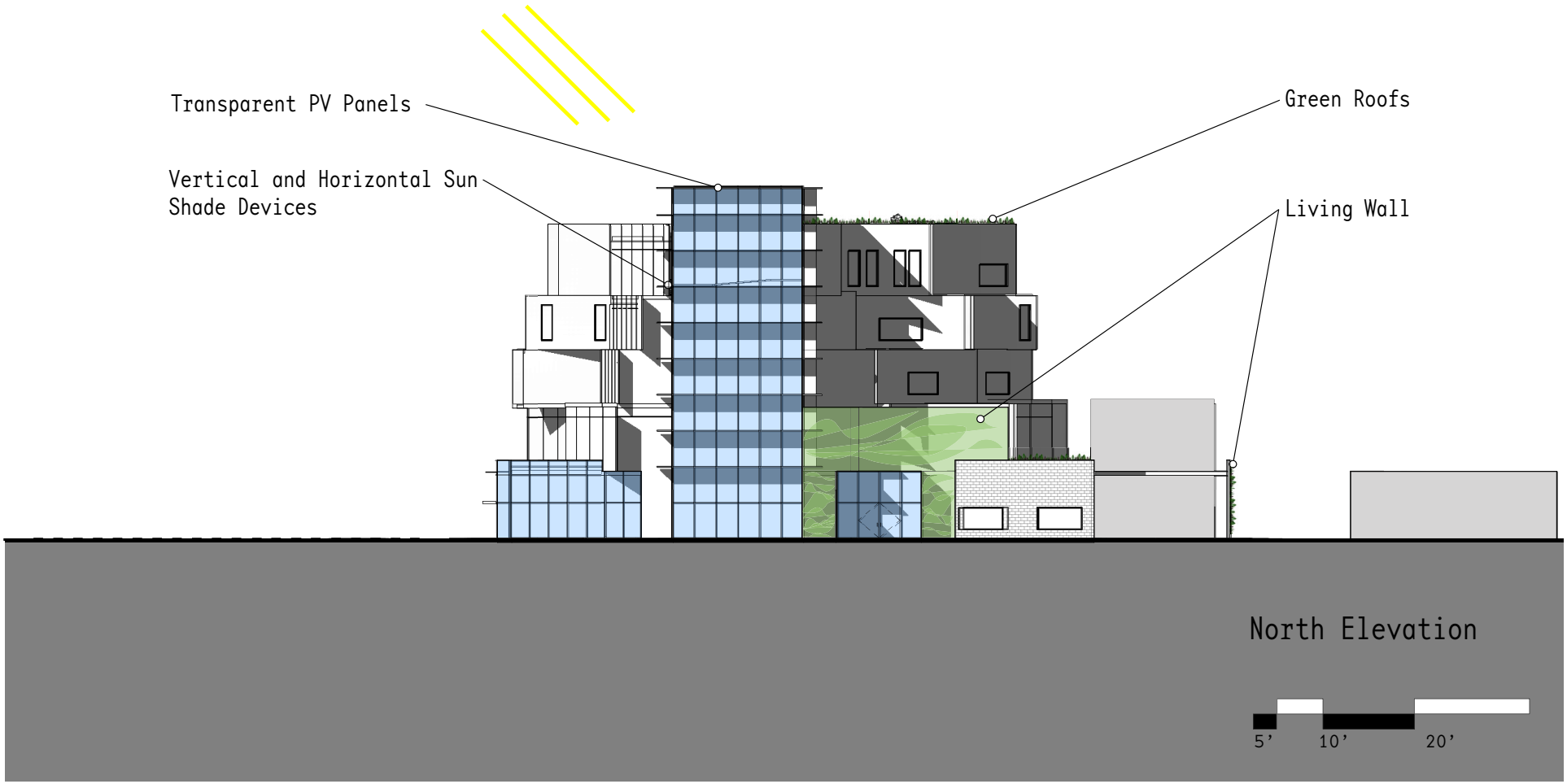


Figure 3.18 Environmental Response Diagram

Due to an environmental response analysis done during design, vertical and horizontal shading devices were added to the ramp in order to shade residents from the sun. In addition, green roofs and living walls were implemented in order to create a substantial thermal barrier which would promote a healthy interior for residents in addition to providing nature for their healing environment. The ramp’s roof is composed of transparent pv panels which create continuity in design while also generating energy for the facility.

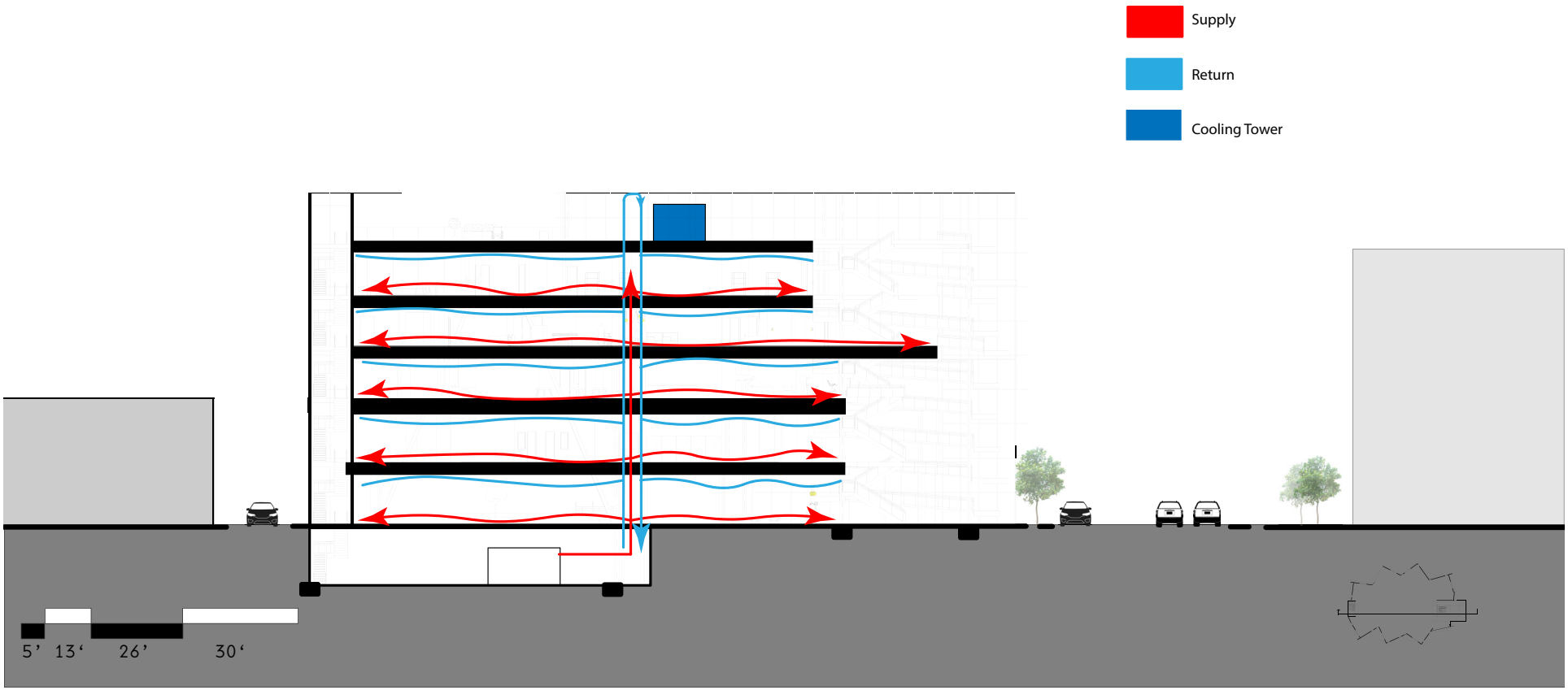
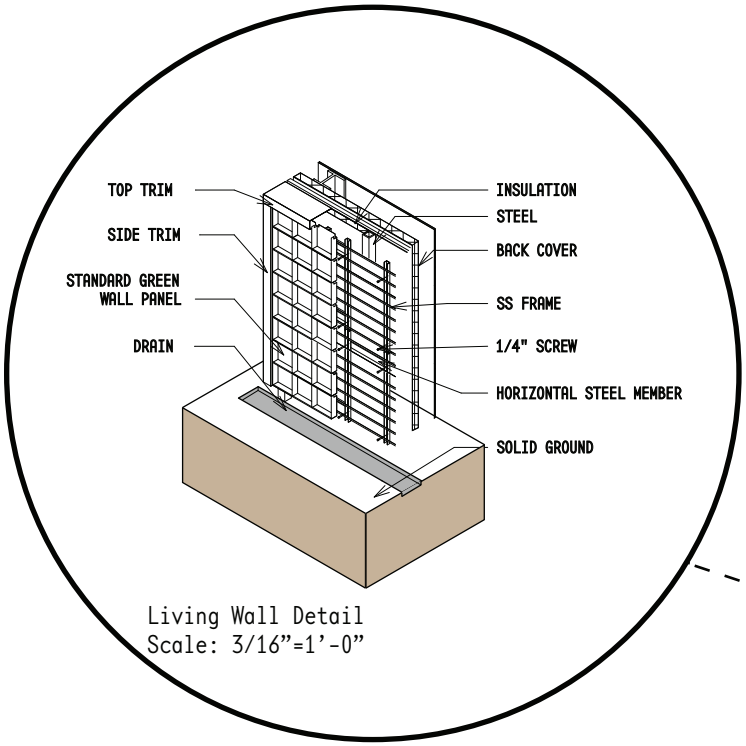


Figure 3.19 HVAC Conceptual Diagram

The HVAC conceptual design is based on a desire to provide a clean and healthy environment for residents. Therefore, a low supply system with a high return was implemented. This creates a more optimal infectious control environment so that infectious agents do not have the opportunity to linger at the residents level. The mechanical systems are located in the lower level with a cooling tower on the roof.



Living Wall Detail
Scale: 3/16”=1’-0”

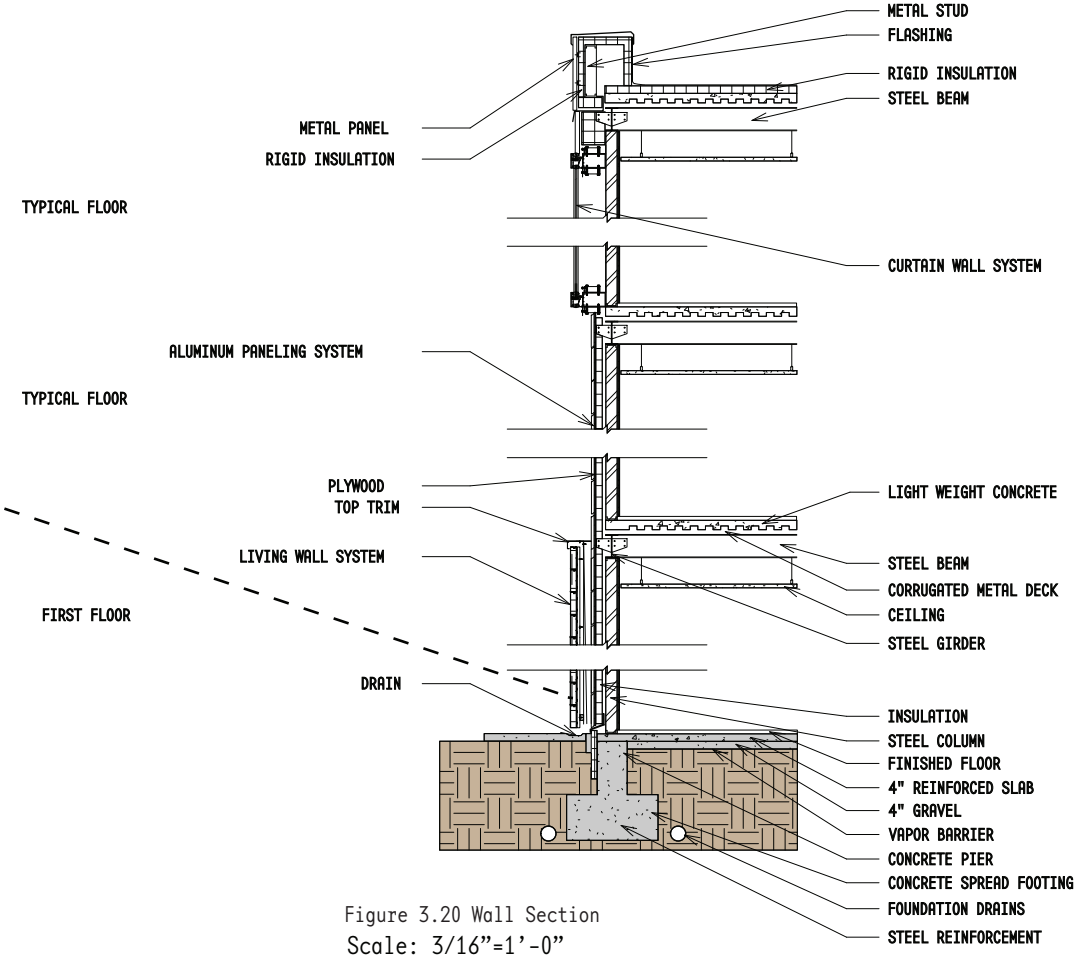


Figure 3.20 Wall Section
Scale: 3/16”=1’-0”

The building is composed of three primary wall types; living wall system, aluminum paneling system, and a curtain wall system. The material choices were selected to create specific experiences inside and outside the building. The ground level is unique in that the materials are natural creating a more human touch compared to the upper levels which are predominately glass and aluminum paneling.

Figure 3.21 North Elevation

The North elevation is the view that visitors would see when entering the building. The entrance is highlighted by the living wall system to the right of the ramp. The building meets the sidewalk in order to encourage public engagement whether its participating in or watching a game of wheelchair basketball or attending a conference in the facility.

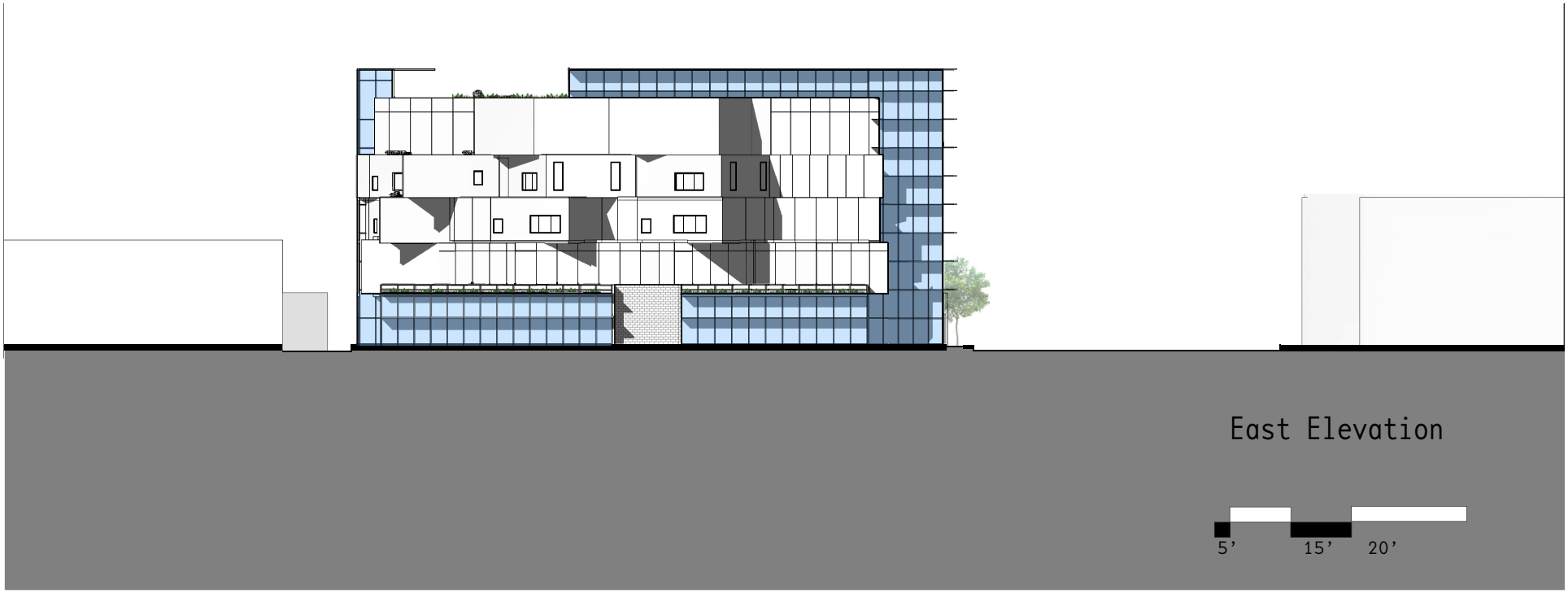


Figure 3.22 East Elevation

The roof features a roof-top garden space. Tasks that require fine motor skills are often challenging for people with a spinal cord injury, so having opportunities outside of formal therapy for them to be outside while exercising these skills can be very beneficial. Being outside in nature can also have a powerful affect on depression so creating an outdoor roof-top garden can act as an oasis, even if residents aree not actively tending to the plants.

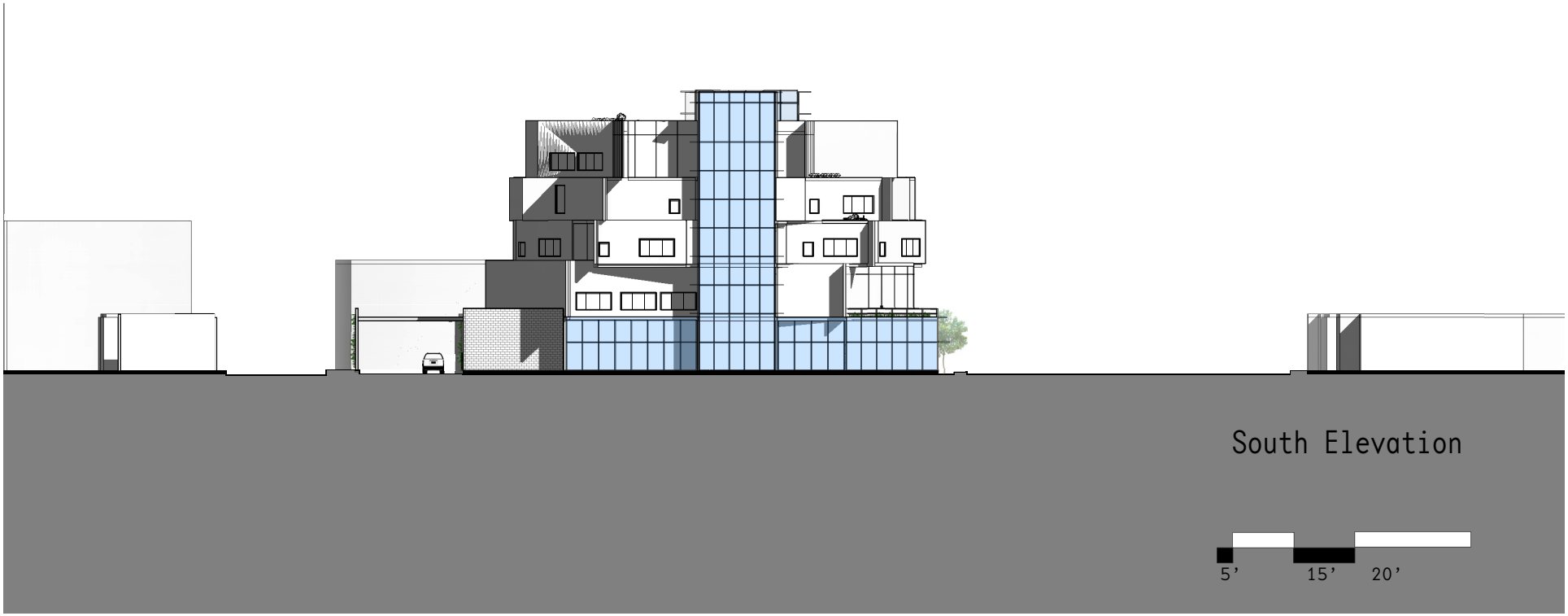


Figure 3.23 South Elevation

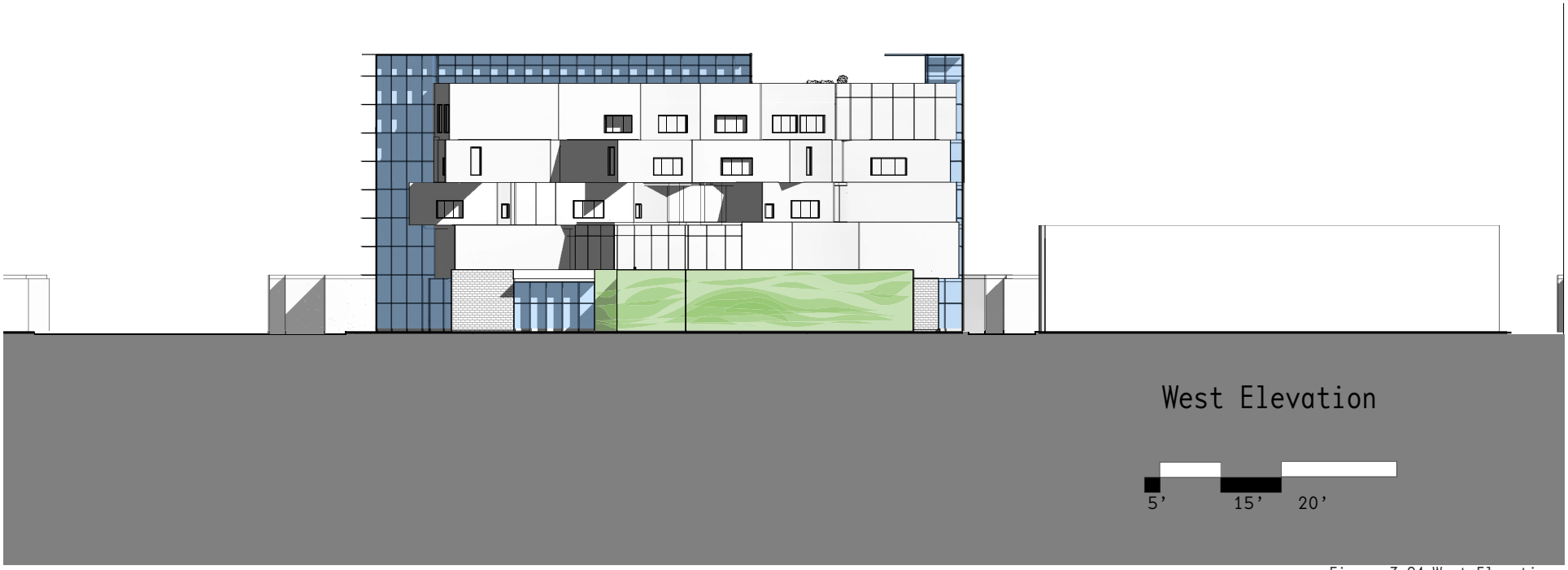


Figure 3.24 West Elevation

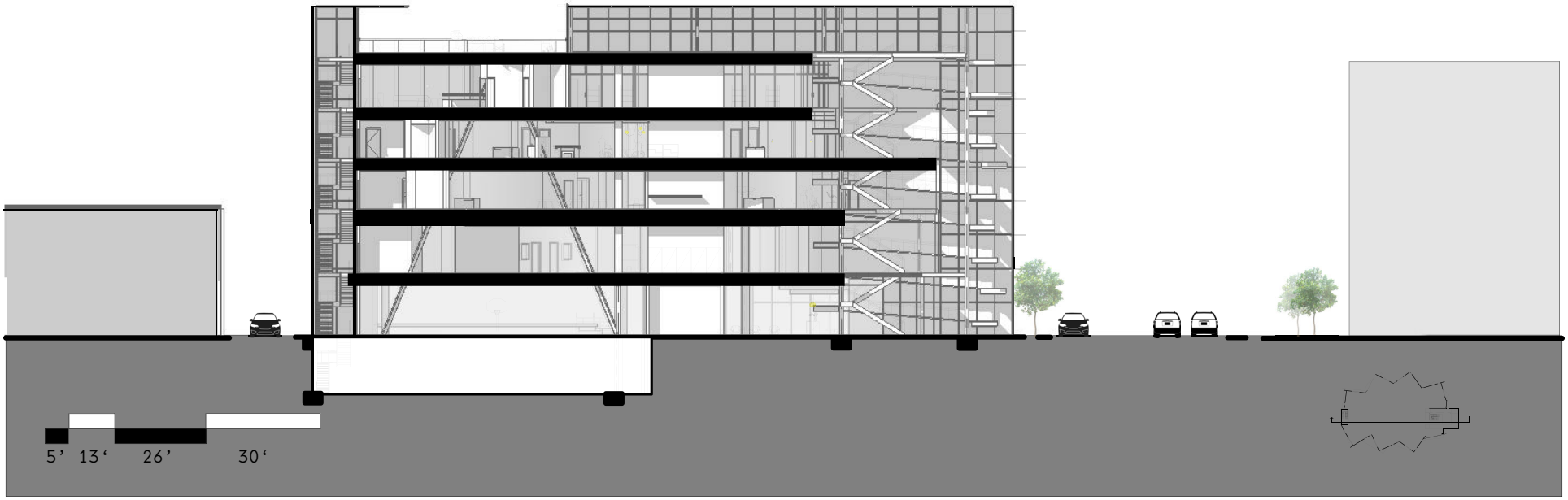


Figure 3.25 Section

Figure 3.26 Section

Figure 3.27 Lobby

Lobby

The lobby is the first place that potential residents and visitors will see. Therefore, the lobby is filled with warm tones and materials. High ceilings and daylighting provide a very bright and open space for people to gather. Substantial space for wheelchair maneuverability was provided and individuals have direct access to the ramp from the lobby which will take them to all floors.

Figure 3.28 Ramp

Ramp

This image is a section perspective of the ramp showing the third and fourth floor, which are the resident room levels. The third floor is where dining takes place and the fourth floor is the multipurpose space. The image shows some of these spaces and how they would be used by residents. Having dining tables near the ramp provide opportunities for residents to engage with one another as they come and go; chance encounters with others are facilitated by the architecture.

Figure 3.29 Multipurpose Space

Multipurpose Space

The multipurpose space is one of the major social spaces in the building. There is a ping pong table, television, board games, and an art space. The purpose of this space is for residents to have fun. The struggle against depression in people with spinal cord injuries can be fought with a family atmosphere and fun with others. The space is very open so that residents can wheel side by side down the hall talking. The hallways have up lighting along the walls in order to create a more comfortable and less clinical environment for residents. It also avoids a flashing effect that often occurs with standard down lighting.

Figure 3.30 Resident Room

Resident Room

The resident room features a roll-in closet, private bathroom, garden, and movable furniture. All resident rooms are equipped with a full area lift so that every room can accommodate every level of injury. This allows the facility to intermingle levels of injury instead of grouping residents by injury. In addition, every room has two windows and a pull out bed so that they can have friends or family stay with them.

RESIDENT ROOM

RESIDENT ZONE

CLINICAL ZONE

FAMILY ZONE

- NURSE SERVER
- ROOM SIZE
  - STANDARD HOSPITAL ROOM: 320 NSF
  - SCI PROPOSED ROOM: 580 NSF
- GREEN ROOF GARDEN
- PRIVATE ROLL-IN CLOSET
- MOVE-ABLE FURNITURE
- HEIGHT ADJUSTABLE DESK

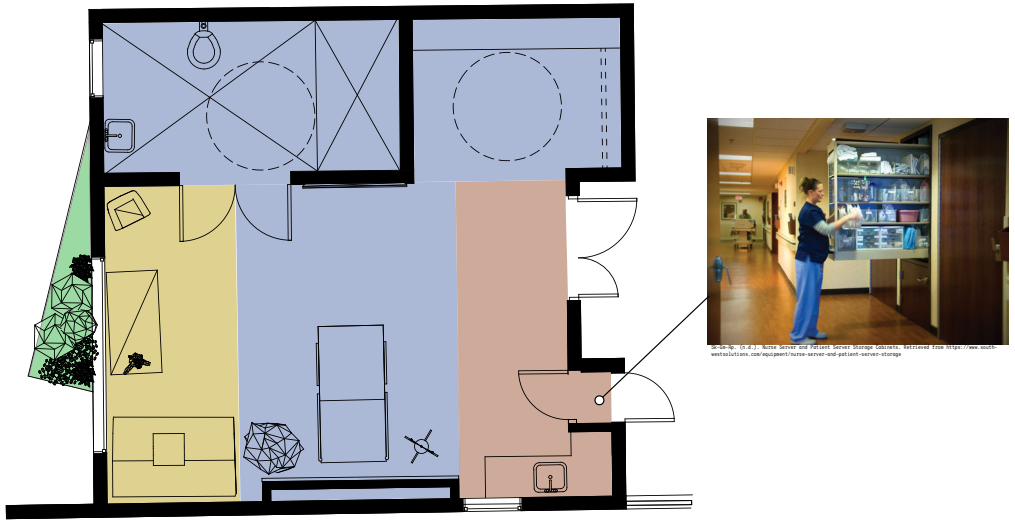


Figure 3.31 Resident Room Diagram

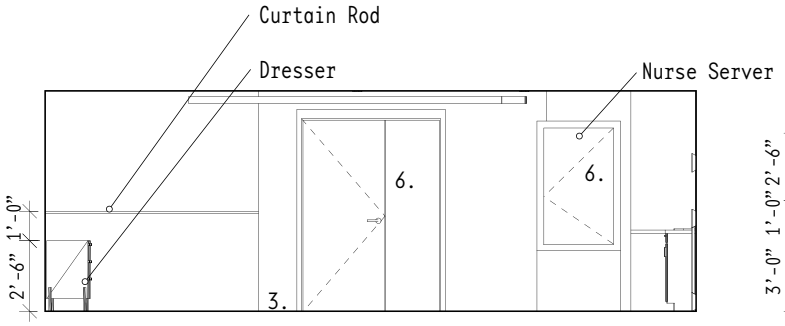
Resident rooms are broken down into three sections: the clinical zone, the resident zone, and the family zone. The flow of people in the space is very important in order to give residents as much independence and privacy as possible. By keeping clinical functions on the corridor side, it limits the need for staff to go all the way into the room unless they are assisting the resident. This layout of zones also keeps family from being in the way of the healthcare staff. Height-adjustable furniture that is also movable allows each resident to personalize their room layout. There are many unique things about this room design compared to traditional SCI rooms such as the nurse server, room size, green roof garden, private roll-in closet, movable furniture, and height adjustable desk. The nurse server allows for staff to restock the room from the corridor at any time of day which gives residents more privacy. Traditionally, residents would have a community storage closet where their things would be stored and only retrieved by staff on request. In addition, a personal closet gives residents independence and the ability to make this their home.

Figure 3.32 Resident Room Diagram

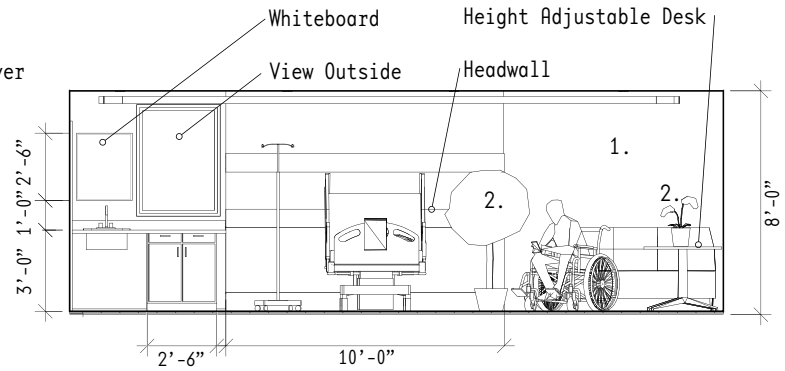
Having access to daylighting and pleasant views has been shown to reduce depression and anxiety which is why it played such a significant roll in the design of the building. It is also very important to have several feet on all sides of the bed so that residents can easily maneuver around and get in and out of their bed. People who are quadriplegic will likely require assistance getting in and out of bed, so having space for not only the individual but potentially 2-3 nurses becomes very important.

RESIDENT ROOM

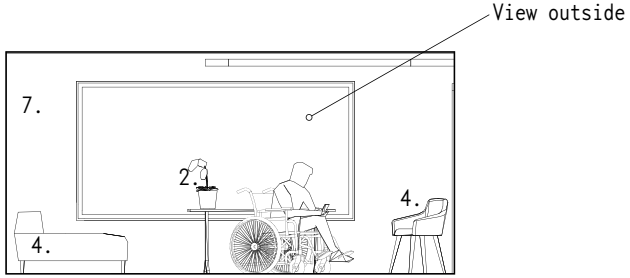
Figure 3.33 Detail Scale Model



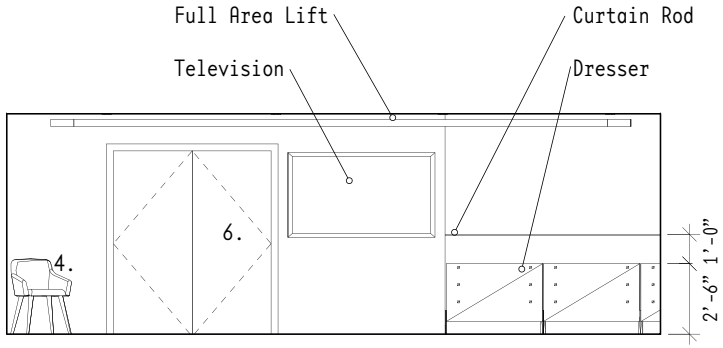
Resident Closet - Exit - Nurse Server



Clinical Area - Resident Area - Family Area



Family Area



Entrance to Toilet/Shower Room - Patient Closet

Figure 3.34 Alcove

Alcove

The interstitial spaces between resident rooms are used as informal gathering spaces. They can also function as display spaces for resident art work or pop-up activities.

04 reflection + conclusion

Architecture should be responsive; striving to adapt to the needs of patients who have spinal cord injuries (SCI) by empowering, protecting, and healing both psychologically and physically. Suicide claims the lives of over 50% of people with spinal cord injuries and there are no standards of design for the facilities that these people call their home.

When I began this thesis project I was going to accomplish my thesis by creating a long term care center for people with spinal cord injuries through daylighting, access to nature, and community. Daylighting and nature were at the forefront of the project in the beginning. Throughout my research the most common topic within healthcare architecture was about daylighting and nature, so I thought it was the solution to my question of how architecture can impact people with spinal cord injuries. Studies have proven the impact that daylighting and access to nature have on depression, so even though these principles did not end up being the answer to my thesis, they played a vital roll in the project.

By creating opportunities for social interactions and movement, Architecture can protect people psychologically and build their physical strength. This is how I actually accomplished my thesis. Healing comes in spaces that are bright, open, brimming with life, and full of laughter. By creating a family atmosphere through programming, adjacencies, and movement, I accomplished my thesis. What I believe gives people purpose to live is belonging to a family and having a purpose in life. The focus on

community drove a lot of the project, but it was working in tandem with daylighting, views, nature, circulation, and privacy.

I believe this thesis project was successful in accomplishing what I set out to do. This facility puts it's residents first, and it is designed for people with spinal cord injuries. This gives them their best chance for healing and returns some of their independence, which they might have felt was lost after their injury. I do think there is room for improvement, specifically in its efficiency. Although this building is successful in creating opportunities for community, it is not as efficient for the doctors and nurses. There could be more space for them to work and more storage for all of the medical equipment that would be needed. If this had been designed to be a larger facility, I would have added a servery and full laundry service so that those services would not need to be contracted out. A common struggle with facilities such as this is financing since many people with SCI cannot work or afford the amount of care they require. This makes it very important that these facilities produce money to supplement these costs and keep yearly costs as low as possible. Next steps in this project would include trying to make this building more economic as well as develop more energy-producing design features such as rain harvesting, additional solar panels, light wells, and operable windows.

In conclusion, this architecture thesis examined an issue that has not been evaluated by many architects, and I think it brings a compelling perspective to the field of

healthcare architecture. My recommendations for further study would be to investigate more of the new technologies and procedures being performed in spinal cord injury. Having research and cutting edge technology in the same facility as residents could mean the difference between walking and not being able to walk for someone. Time is sensitive for this type of injury as well as consistency, making it imperative that doctors be heavily involved in the rehabilitation process. Material studies and studies on outdoor spaces for people in wheelchairs would also benefit this typology. Integrating therapy with enjoyable activities such as gardening or sports would keep residents motivated in therapy. Spinal cord injuries affect over 300,000 people in the US alone, making this an issue that we should all be concerned about. Architecture has the ability to facilitate healing, and architects should rise to the challenge.

05 bibliography

Aksamija, Ajla. Integrating Innovation in Architecture : Design, Methods and Technology for Progressive Practice and Research West Sussex, United Kingdom: John Wiley & Sons, Ltd., 2016.

Alarcón, Jonathan. “Spaulding Hospital / Perkins Will.” ArchDaily. ArchDaily, November 1, 2013. https://www.archdaily.com/443408/spaulding-hospita-perkins-will?ad_source=search&ad_medium=search_result_all.

DeVivo, M J, K J Black, J Scott Richards, and S L Stover. “Suicide Following Spinal Cord Injury.” Nature News. Nature Publishing Group, n.d. https://www.nature.com/articles/sc199191.

Kalantari, Saleh, and Robin Snell. 2017. Post-occupancy evaluation of a mental healthcare facility based on staff perceptions of design innovations. HERD : Health Environments Research & Design Journal 10, (4) (07): 121-135, https://search-proquest-com.proxy.bsu.edu/docview/1913060049?accountid=8483 (accessed September 9, 2019).

Killington, Maggie, Dean Fyfe, Allan Patching, Paul Habib, Annabel McNamara, Rachael Kay, Venugopal Kochiyil, and Maria Crotty. 2019. “ Health Expectations 22 (3): 396-404.

Kraus, Shannon and Kate Renner. 2016. “Architecture for Population Health. How Facility Designs can Help to Build Healthy Communities.” Health Facilities Management 29 (10): 25-29.

Lang, Jon T. Designing for Human Behavior: Architecture and the Behavioral Sciences. Stroudsburg, Pa: Dowden, Hutchinson & Ross, 1974.

“Leeds Mum’s ‘Delight’ at Maggie’s Cancer Centre.” The Yorkshire post. (January 23, 2018).

Mirzaei, Narek. “Healing by Design Evidence-Based Approach in Designing Brain & Spinal

Cord Injury Rehabilitation Center.” Healing by Design Evidence-Based Approach in Designing

Brain & Spinal Cord Injury Rehabilitation Center. ProQuest Dissertations Publishing, 2017.

- NSCISC Application, n.d. https://www.nscisc.uab.edu/Public_Pages/FAQ.

Paraskevopoulou, Angeliki Triandafillou and Emmanouela Kamperi. 2018. “Design of Hospital

Healing Gardens Linked to Pre- Or Post-Occupancy Research Findings." Frontiers of Architectural Research 7 (3): 395-414.

"Quality of Life: What's Important." Craig Hospital, n.d. https://craighospital.org/resources/quality-of-life-whats-important?topic=14803.

"Shirley Ryan AbilityLab: Projects." Gensler. Accessed November 7, 2019. https://www.gensler.com/projects/shirley-ryan-abilitylab.

Schuler, Timothy A. "Maggie's Manchester Centre Timber Frame." Architect 106, no. 12 (2017): 84.

Stephens, Suzanne. 2005. "REHAB, Center for Spinal Cord and Brain Injuries, Basel, Switzerland." Architectural Record 193 (6): 116-[121]. http://search.ebscohost.com.proxy.bsu.edu/login.aspx?direct=true&db=bvh&AN=569569&site=ehost-live&scope=site.

Suematsu, Katsuya "Enabling Architecture- Rehabilitation and Therapeutic Environment -." Electronic Thesis or Dissertation. University of Cincinnati, 2010. https://etd.ohiolink.edu/

"Spinal Cord Injury (SCI) Model System." SCI Model System | Model Systems Knowledge Translation Center (MSKTC), May 1, 1970. https://msktc.org/about-model-systems/sci.

Thompson, John D., and Goldin, Grace. The Hospital : a Social and Architectural History New Haven: Yale University Press, 1975.

"Three Steps to Finding the Right Rehabilitation Center." Brain and Spinal Cord, June 10, 2019. https://www.brainandspinalcord.org/three-steps-to-finding-the-right-rehabilitation-center/.

Figure 2.1 Man in Exoskeleton. Retrieved from: Google Images. 29 April 2020.

Figure 2.2 Man with Paraplegia in Wheelchair. Retrieved from Google Images. 29 April 2020.

Figure 2.3 Woman with Quadriplegia in Wheelchair. Retrieved from Google Images. 29 April 2020.

Figure 2.4 Model Center Map. Retrieved from https://msktc.org/about-model-systems/sci 29 April 2020.

Figure 2.5 Melissa Tharp. Levels of Injury. 2020

Figure 2.6 Exam Room. Retrieved from https://www.cfm.va.gov/til/dGuide.asp. 29 April 2020.

Figure 2.7 Physical Therapy Room. Retrieved from https://www.cfm.va.gov/til/dGuide.asp. 29 April 2020

Figure 2.8 Multipurpose Room. Retrieved from https://www.cfm.va.gov/til/dGuide.asp. 29 April 2020.

Figure 2.9 Melissa Tharp. Site from West-South. 2019.

Figure 2.10 Melissa Tharp. Site from West. 2019.

Figure 2.11 Melissa Tharp. Abandoned apartment building. 2019.

Figure 2.12 Melissa Tharp. Site Analysis. 2020

Figure 2.13 Melissa Tharp. Sidewalk on East side of site. 2019.

Figure 2.14 Melissa Tharp. North of site across 16th Street. 2019.

Figure 2.15 Melissa Tharp. Site Diagrams. 2020

Figure 2.16 Melissa Tharp. Monumental Scale Model. 2020

Figure 2.17 Exterior of Shirley Ryan. Retrieved from https://www.gensler.com/projects/shirley-ryan-abilitylab

Figure 2.18 Ability Lab. Retrieved from https://www.gensler.com/projects/shirley-ryan-abilitylab

Figure 2.19 Patient Room. Retrieved from https://www.gensler.com/projects/shirley-ryan-abilitylab

Figure 2.20 Ability Lab Stairs. Retrieved from https://www.gensler.com/projects/shirley-ryan-abilitylab

Figure 2.21 Ability Lab. Retrieved from https://www.gensler.com/projects/shirley-ryan-abilitylab

Figure 3.31 Resident Room Diagram. Melissa Tharp. 2020

Figure 3.32 Resident Room Diagram. Melissa Tharp. 2020

Figure 3.33 Detail Scale Model. Melissa Tharp. 2020

Figure 3.34 Alcove. Melissa Tharp. 2020